EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-02

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-D-14-031	10/01/2014 To 09/30/2015	WA 0-02 CLIMATE CHANGE IMPACTS
	Base X Option Period Number	

Contractor: INDUSTRIAL ECONOMICS, INCORPORATED

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 10/01/2014 To 09/30/2015

Comments:
THIS ACTION INITIATES WA 0-02 "CLIMATE CHANGE IMPACTS ANALYSIS AND SECTORAL MODELING" WITH AN INITIAL LOE OF 100 HOURS FOR START UP WORK. THE CONTRACTOR SHALL SUBMIT A WORK PLAN AND COST ESTIMATE IN ACCORDANCE WITH THE CONTRACT TERMS AND CONDITIONS. I CERTIFY THAT THE WORK ORDERED DOES NOT DUPLICATE ANY WORK PREVIOUSLY PERFORMED UNDER MY AUTHROITY.

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

	Cost/Fee:	LOE:
Contract Period: 10/01/2014 To 09/30/2015		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Jeremy Martinich (Signature) (Date)	Branch/Mail Code: Phone Number: 202-343-9871 FAX Number:
Project Officer Name: Lorraine Reddick (Signature) (Date)	Branch/Mail Code: Phone Number: 202-564-1293 FAX Number:
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: Andrew Flynn Andrew Flynn (Signature) 10-20-14 (Date)	Branch/Mail Code: Phone Number: 919-541-2674 FAX Number: 919-541-0611

WORK ASSIGNMENT

Title: Climate Change Impacts Analysis and Sectoral Modeling

Work Assignment Manager/COR: Jeremy Martinich
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STATEMENT OF WORK
Technical Support Climate Change Impacts and Benefits Analyses

I. INTRODUCTION

The Climate Change Division (CCD) in the U.S. EPA's Office of Air and Radiation works to assess and address global climate change and the associated risks to human health and the environment. The CCD plays a key role in United States and international efforts to address climate change by:

- Implementing successful voluntary programs to reduce non-carbon dioxide (CO2) emissions;
- Analyzing rigorously CO_2 and non-CO_2 greenhouse gas (GHG) emissions and economically efficient mitigation and adaptation options;
- Communicating climate analyses and strategies to policy-makers, experts and U.S. climate negotiators;
- Building effective international capacity to analyze and reduce GHG emissions and associated air pollution; and
- Educating the public on climate change.

CCD also has experience in assessing climate change vulnerability and integrating information on climate science, impacts, and adaptation into broader analytical frameworks.

This Statement of Work (SOW) supports EPA in implementing several activities that are required to fulfill the mission of the CCD.

II. BACKGROUND

Understanding the risks of the physical impacts and economic damages associated with different levels of future climate change is essential to informing policy decisions designed to address these risks. The Climate Change Impacts and Risk Analysis (CIRA) project is an on-going project to estimate the benefits of GHG mitigation, and to complement the well-developed capacity to model the costs of climate policies. This effort focuses on two primary goals: first, to assess the degree to which global GHG mitigation may avoid or reduce climate change-related risks and damages in the US compared to a future without mitigation policy; and second, to clearly articulate and analyze several key sources of uncertainty in estimating these benefits. To achieve these goals, CIRA estimates climate change impacts and damages, including changes in risks associated with key sources of uncertainty, for multiple sectors in the US under a reference future and two global GHG emissions mitigation scenarios. This multi-model framework enables development of consistent estimates of the benefits of climate change policy across these multiple impacts sectors.

The purpose of this task order is to provide CCD with support to further implement the CIRA project, including completing a CIRA communications report, running a subset of CIRA sectoral

models using new emission/climate scenarios, developing response functions for all impacts categories, completing an energy infrastructure module of the National Coastal Property Model (NCPM), and providing general CIRA program support through quick turnaround requests.

III. TASKS

The Contractor shall perform the work described below in the following five (5) tasks.

Task 0. Develop Workplan and Project Management

The Contactor shall provide a workplan outlining the approach, resources, timeline, and estimated costs for all tasks listed below. Estimates of costs and hours shall be presented by professional level and month. The Work Assignment Manager (WAM) will review the workplan and will request revisions and or changes as needed. If necessary, the Contractor shall incorporate EPA comments into the final workplan.

The Contractor shall provide project management under this task. During the period of performance, the Contractor shall immediately inform the WAM and CO by telephone and/or email of any problems that may impede performance along with any corrective actions needed by the EPA or the Contractor to solve the problem.

Under this task, the Contractor shall also attend a kick-off meeting via conference call to discuss the goals and strategy for completing future deliverables on a schedule to be determined. This kick-off meeting will serve as a discussion to clarify the EPA's requirements, solicit ideas and feedback from the Contractor, as well as formulate ideas for work to be completed by the Contractor under the Tasks listed below. The Contractor will also participate in one or more wrap-up discussions at the end of the period of performance, or when the necessary support has been completed, to discuss work completed under the tasks below.

Deliverable	Due Date
Task 0.1: Participate in Kick-off Meeting	Within 5 business days of work assignment award.
Task 0.2: Workplan and cost estimate to EPA	Within 20 days after receipt of this work assignment.
Task 0.3: Monthly Status Report	By 10th business day each month, or another agreed upon date with the COR.
Task 0.4: Attend wrap-up discussion	Due dates for these discussion will be outlined in technical direction.

Task 1. Support for Summarizing and Synthesizing CIRA Results for New EPA Report

EPA is developing a report that describes the domestic multi-sectoral benefits of global GHG mitigation to inform climate policy discussions. This ~70 page report will describe projected changes in climate, impacts and benefits across sectors, and syntheses of national and regional impacts. The document is being developed for a policymaker audience, with content also appropriate for public consumption. This report, which will have a look and feel similar to the EPA's climate change indicators report[1], is currently scheduled for release in spring 2015. Although the methods and results of this report will have already been published in the scientific literature, the report will be independently and externally peer-reviewed by a separate contractor.

By the initiation of this work assignment, approximately two-thirds of the report will have been drafted and gone through preliminary review. The purpose of this task is to support EPA in:1) completing the content for the report, including development of text and figures/graphics for the remaining sectoral and synthesis sections, 2) revising the report in response to comments from peer reviewers and EPA offices, and 3) preparing the final report for release (final layout and formatting).

The Contractor shall perform the following activities in support of this Task:

- Continue to support EPA staff in drafting the sectoral impacts and benefits sections of the report. By the end of September 2014, the following sections of the report will have been drafted and gone through preliminary review by EPA staff and technical contributors: introduction, CIRA process, climate projections, uncertainty framework, health (water quality), infrastructure (roads, coastal development, bridges, urban drainage), electricity (demand, supply), water (drought, water S/D), ecosystems (coral, fish, shellfish, carbon storage, wildfires), synthesis (common themes, limitations, value of additional mitigation, extreme climate change), and conclusion. Therefore the purpose of this new work is to complete drafts of the remaining sections, which include: health (air quality, extreme temp. mortality, labor supply), water (flooding damages), electricity (hydropower and thermo-cooling), agriculture, forestry, synthesis sections (national scale, regional scale, EJ analyses). This new work shall include capacity to develop new graphical images and figures to display the risk of inaction and mitigation benefit results in a visually appealing and simple to understand manner.
- Undertake new work to develop print-ready spreads for the sections that have been drafted (listed in the previous bullet) and already undergone internal EPA-CCD and CIRA collaborator reviews.
- Support EPA in completing technical documentation that will accompany the report. This supplementary piece will provide additional technical details that are not included in the main report. The Contractor's primary responsibilities will be to: 1) collate and organize all data underlying the figures presented in the report into a single Excel workbook, and 2) do basic formatting to the technical documentation report (InDesign likely not necessary).
- Work with EPA to develop a complete draft of the CIRA report that will begin peer review on November 17th. A complete draft of the report, in both Word and InDesign

[1] http://www.epa.gov/climatechange/pdfs/climateindicators-full-2012.pdf

formats, shall be submitted to the WAM no later than November 10th for final review prior to the initiation of the external peer review.

- Work with EPA in responding to comments from the peer reviewers by revising the content of the report. The Contractor shall be prepared to support EPA staff in developing a response to comments table (describing how the comments were addressed) that will become part of the peer review record for the report.
- Develop a two-page factsheet describing the report to aid in raising awareness of the report.
- Upon completion of expert and internal EPA reviews, the Contractor shall prepare a final version of the report for release.

Deliverable	**Due Date**
Task 1.1: Drafts of remaining sectoral and synthesis sections	No later than October 31st
Task 1.2: Draft print-ready spreads for remaining sections	No later than November 5th
Task 1.3: Compiled draft of report ready EPA review	No later than November 10th
Task 1.4: Compiled draft of report ready for peer review	No later than November 17th
Task 1.5: Final response to comments table	By March 14th, 2015
Task 1.5: Compiled file of all data underlying figures in the report	By March 14th, 2015
Task 1.6: Formatted technical documentation sent to EPA	By April 18th, 2015
Task 1.7: Final report ready for release	By April 25th, 2015

Task 2. Running of Sectoral Impact Models Using New CIRA Scenarios

As a next step on the CIRA project, CCD is interested in estimating climate change impacts and mitigation benefits across sectors using a wider set of radiative forcing targets: total forcing of 2.6W/m^2, 6.0W/m^2, and 7.4 W/m^2, to complement the existing CIRA Reference (10.0W/m^2) and Policy 3.7 and 4.5 scenarios. This will allow the CIRA project to both estimate impacts for global emission scenarios that are closer to the Reference (i.e., the 6.0 and 7.4 targets would be useful for analyzing the implications of only marginally successful mitigation global efforts), and a scenario that is more stringent than the Policy 3.7 scenario (i.e., allowing for the exploration of impacts in a future where global mean temperature increase is limited to 2°C or less).

Using the new CIRA emission and climate scenarios, the Contractor shall apply the following two post-processing models and nine sectoral models to estimate impacts and damages. The Contractor shall pay close attention to the methods of these additional model simulations to ensure that the approach used in the original CIRA runs is duplicated and that no inconsistencies are introduced.

This work shall commence as soon as the climate data has been processed (occurring outside of this Work Assignment) is ready for use. For each model, the Contractor shall prepare a short write-up (in the form of a memo or powerpoint, whichever is most appropriate for that analysis) describing the results for each scenario, including maps and relevant graphics that visually display the findings. In all cases, the Contractor shall update the spreadsheets of results for each modeling analysis (to be supplied by the COR), and ensure that the data is clearly identifiable and useable in the spreadsheets.

Post-processing models:

1) CLIRUN runoff model, as applied in Strzepek et al. (2014)[2].

2) Application of dynamic ice sheet melting adjustments to IGSM global sea level rise values, as applied in Neumann et al. (2014)[3].

Sectoral models:

1) National Coastal Property Model (with storm surge and new energy infrastructure module if appropriate), as applied in Neumann et al. (2014).

2) Road infrastructure, as applied in Neumann et al. (2014).

3) Drought risk and valuation, as applied in Strzepek et al. (2014).

4) Urban drainage infrastructure (50 cities), as applied in Neumann et al. (2014).

5) Water quality using USBasins (methodological journal paper in review).

6) Thermo-electric cooling vulnerability analysis (methodological journal paper in review).

7) Wildfire fuel suppression costs as proxy of ecosystem service values (methodological journal paper in review).

8) Integrated Planning Model (IPM), as applied in McFarland et al. (2014)[4].

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[2] Strzepek K, Neumann J, Smith J, Martinich J, Boehlert B, Hejazi M, Henderson J, Wobus C, Jones R, Calvin K, Johnson D, Monier E, Strzepek J, Yoon J. (in review) Benefits of Greenhouse Gas Mitigation on the Supply, Management, and Use of Water Resources in the United States. Climatic Change.

[3] Neumann JE, Price J, Chinowsky P, Wright L, Ludwig L, Streeter R, Jones R, Smith JB, Perkins W, Jantarasami L, Martinich J (2014) Climate change risks to US infrastructure: impacts on roads, bridges, coastal development, and urban drainage. Climatic Change. doi:10.1007/s10584-013-1037-4.

[4] McFarland J, Zhou Y, Clarke L, Schultz P, Sullivan P, Colman J, Patel P, Eom J, Kim S, Kyle GP, Jaglom W, Venkatesh B, Haydel J, Miller R, Creason J, Perkins B (in review) Climate Change Impacts on Electricity Demand and Supply in the United States: A Multi-Model Comparison. Climatic Change.

9) Forestry and Agricultural Sector Optimization Model (FASOM) (methodological journal paper in review).

Deliverable	Due Date
Task 2.1: Complete post-processing models	Within 3 weeks of receipt of processed data.
Task 2.2: Completed results write-ups (8) for each model/analysis	Within 12 weeks of receipt of processed data.
Task 2.3: Updated results spreadsheets	Within 12 weeks of receipt of processed data.

Task 3. Creating Reduced-form Functions of Impacts

One objective of running the additional emission scenarios through the sectoral models (Task 2) is to develop capacity within the CIRA project to create reduced-form representations (response functions) of the individual impacts. If successful, this will allow for quicker turnaround of analyses requested by others, and also enable the evaluation of 'custom' levels of mitigation (including marginal scale reductions).

Using previous CIRA results, those generated in Task 2, and results from sectoral model simulations being conducted outside of this Statement of Work, the Contractor shall develop aggregate response functions for each impact in the CIRA project. In performing this task, the Contractor shall ensure the use of individuals with sufficient technical experience with the CIRA sectoral results, as well as individuals with technical expertise in developing aggregate response functions.

As the first deliverable under this Task, the Contractor shall develop a memo describing the proposed approach for creating the response functions using the CIRA sectoral results. Based on comments from the COR on the proposed approach, the Contractor shall revise accordingly and proceed with developing the response functions. Upon completion, the Contractor shall develop a memo that includes: 1) a description of the approach taken in developing the functions, 2) technical details regarding the functions (e.g., equations), 3) relevant graphics displaying the functional form/curves, 4) important considerations for the use and application of the functions, and 5) other relevant information necessary for documenting the methodology behind their development.

Deliverable	Due Date
Task 3.1: Memo describing approach for creating reduced-form functions of sectoral impacts.	Within 1 month of completion of Task 2.3.

Task 3.2: Memo describing final approach, technical details, functional forms, and documentation.	Within 6 weeks of delivering the Task 3.1 (approach) memo.

Task 4. Completing Enhancements to the National Coastal Property Model

Using the NCPM, EPA has supported model advancements to estimate the vulnerability of critical energy system installations in the contiguous US. This previous work developed capacity to estimate the vulnerability of this type of infrastructure, but did not incorporate modeling capabilities to estimate the value of what's at risk (including residual effects), nor the estimation of adaptation response options (and their costs) for these types of energy installations. The purpose of this task is to perform these latter steps, thereby creating a full energy infrastructure module if the NCPM.

The Contractor shall develop a memo describing the methods and results of the completed energy installation module for the NCPM. Graphics and maps displaying vulnerability and adaptation response over time, as well as associated economic costs, should be included.

Deliverable	**Due Date**
Task 4.1: Memo describing methods and results of the completed module	No later than January 30th, 2014

Task 5. Technical Support and Quick Turnaround Assistance

As the above tasks proceed, EPA is likely to require technical support and quick turnaround assistance related to the work outlined in this SOW. The Contractor shall be expected to perform three of these technical support tasks, each requiring approximately 30 hours of work. As requested per technical direction from the COR, the Contractor shall support EPA by:

- Providing background materials for presentations/briefings.
- Providing additional compilations of CIRA climate or sectoral impacts data for usage in other analyses.
- Paying open access publication fees for CIRA papers, including by not limited to the following manuscripts: water quality, hydro/thermo-cooling, wildfire fuel management costs.
- Reviewing drafts of sectoral impacts summaries produced by EPA and collaborators.

As stated above, this work will be initiated through technical direction, and these communications will include specific details regarding the work, including delivery dates.

Deliverable	**Due Date**

Task 5.1: Technical support deliverable as defined in technical direction from the COR.	Within 3 weeks of initial technical direction from the COR.

IV. PERIOD OF PERFORMANCE

The period of performance for this Work Assignment is from date of issuance to September 30th, 2015.